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Description

Process and apparatus to cool harvest grapes

The invention relates to a process for producing wine, the grapes being transported from a harvest reception vessel to a press or fed to a maceration vessel. In addition, the invention relates to an apparatus for cooling grapes between a harvest reception vessel and a press or a maceration vessel.

In wine production, the conventional sequence is known in which the grapes after harvest pass into a vessel (harvest reception vessel), from which they are transported to the press. To produce a better wine the grapes are subject to a maceration process for a few hours before the fermentation process. The grapes are put to a maceration vessel to extract flavours from the grape skins. The grapes remain in the maceration vessel for a few hours before the fermentation process begins. There are also wine producing installations that do not comprise a maceration vessel. In this case the maceration takes place in the press. The formation of flavour is particularly effected by the conditions (for example temperature, residence time) in the above-described production steps.

The object underlying the present invention is to provide an improved process and an apparatus suitable for improvement in wine flavour.

On the processing side, the object set is achieved by the fact that the grapes are charged with carbon dioxide during transport to the press and/or maceration vessel.

If the grapes are charged with carbon dioxide during transport to the press and carbon dioxide is introduced into the maceration vessel for cooling the grapes

during maceration, an outstanding improvement of the wine taste is achievable.

Expediently, carbon dioxide is brought into contact with the grapes. It has proved to be particularly favorable to add carbon dioxide until the grape temperature is somewhat more than 7°C.

The carbon dioxide is fed to the grapes with great advantage as gaseous carbon dioxide, as liquid carbon dioxide and as solid carbon dioxide or dry ice.

The input of gaseous carbon dioxide creates an inert atmosphere for the grapes.

The input of liquid carbon dioxide causes a significant drop in grape temperature that helps to improve the taste. A drop of temperature is also achievable by introducing cold carbon dioxide gas, preferably cold carbon dioxide gas gained from a liquid carbon dioxide source.

With the injection of liquid carbon dioxide dry ice and gaseous carbon dioxide may be generated depending on the design of the injector. The injection of dry ice is favorable fpr a smooth cooling down of grape temperature due to the sublimation taking place.

Preferably, the carbon dioxide fed in the liquid state to the grapes is at least in part taken from a reservoir which contains liquid carbon dioxide. Such a reservoir has an advantageously high storage density.

On the apparatus side, the object set is firstly achieved by means of the fact that a feeder is provided for carbon dioxide, via which the carbon dioxide is added to the connection line upstream of the press.

Secondly, the object set is also achieved by means of

the fact that a feeder for carbon dioxide is provided in the connection line to the maceration vessel.

According to a particularly preferred embodiment of the invention, both solutions are combined, so that a feeder for carbon dioxide is provided via which the carbon dioxide is added to the connection line upstream of the press and a feeder for carbon dioxide is provided into the connection line to the maceration vessel.

The two embodiments solve the object set of improving the wine flavour not only in each case individually, but also in combination with one another, a particularly outstanding flavour being able to be achieved in the combination.

Expediently, the feeder for carbon dioxide is connected to a reservoir for carbon dioxide which contains liquid and gaseous carbon dioxide.

The invention and other details of the invention will be described in more detail below with reference to an exemplary embodiment shown diagrammatically in the figure. The figure shows a diagram for wine production: the grapes, after harvest, are introduced into the harvest reception vessel 1, from which they are transported to a vessel 2 from which they are fed using a pump 3 via a connection line 4 to the press 5 or to a maceration vessel 23. The way of the grapes is determined by the position of the valves 20, 21 and 22. A plurality of temperature measuring points are installed on the transport path of the grapes and used to determine the respective grape temperature. The inlet temperature is measured by the measuring device 6 and sent to a programmable logic controller (PLC). This temperature is compared to a set point (desired temperature) and the amount of carbon dioxide to be fed through valve 12 is calculated by the PLC. The valve 12

is a regulation valve, its opening degree is driven by the PLC. The valves 18 and 19 are used to choose the line along which the grapes are transported, e.g. to the press 5 or to the maceration vessel 23. The temperature measuring devices 8 and 9 control the temperature after the injection of carbon dioxide. In case of a drop in temperature exceeding a pretermined intervall, the injection of carbon dioxide is shut down by the PLC. This control function is very important to avoid freezing of the transport pipes and lines, in case the grape flow is not at correct speed.

Carbon dioxide is fed from at least one reservoir for carbon dioxide (not shown) via a line 10 which bears liquid carbon dioxide and has a pneumatic regulation valve 12, and a line 11 which bears gaseous carbon dioxide and has an electrically operated valve 13. If only one reservoir is present, the line 11 is thus connected to the head space of the reservoir where the carbon dioxide is present in the gaseous state, and the line 10 is disposed further down, so that via the line 10 liquid carbon dioxide can be taken from the reservoir. The two lines 10 and 11 are combined into one line 14. The line 14 has a safety valve 15. The carbon dioxide is apportioned between the lines 16 and 17 each of which has an electrically operated valve 18, 19. Opening the electrically operated valve 18 enables carbon dioxide to be introduced into the connection grapes transport line 24. Opening the electrically operated valve 19 enables carbon dioxide to be introduced into the connection line 25 bearing grapes. The valves 20, 21 and 22 represent diagrammatically the possibilities of feeding grapes into the press, the maceration vessel 23 and for further processing. The possibilities result from the potential combinations of the two valve settings (open or closed) for the valves 20, 21 and 22.

In the exemplary embodiment, the use of the

programmable logic controller PLC will also be described in more detail. Control points for this controller are the harvest temperature (measured at the temperature measuring point 6), the grape sensor 7 which determines whether grapes are present in the vessel 2, the valve position of the valves 20, 21 and 22 and the temperature at the temperature measuring points 8 and 9. The controller (PLC) first compares the temperature value determined at the temperature measuring point 6 with a pre-set value. If grapes are present in the vessel 2, the pump 3 is started. At least one valve 21, 22 must be open, then the feed of carbon dioxide is also started. The injection line is choosen by opening the valve 18 or 19. First the valve 13 (gaseous state) is open for a few seconds to rise the pressure and clean the injector inside the connection to the grapes transport pipe. Second the valve 12 (liquid state) is open gradually, the valve 13 is closed.

There are two main operating possibilities:

If the users choice is only to protect the grapes by an inert gas during transport, only the valves 18 or 19 and the valve 13 is openend, in case all conditions controlled by the PLC are fulfilled. Carbon dioxide gas is injected during all transport time. The valve 12 stays in closed position.

For lowering the temperature of the grapes significantly the valve 12 has to be opened. In contrary to the first possibility, where the valve 12 stays closed and there is only gaseous input, there is a significant drop in temperature with the second possibility of injecting liquid carbon dioxide .

As described before, the injection of liquid carbon dioxide can generate dry ice which is very favorable for cooling the grapes smoothly.

The grapes are at least inertized. Depending on the amount of carbon dioxide fed and its temperature, the grapes are additionally cooled, preferably to a temperature of 7°C. The temperature of the carbon dioxide can be varied by the valve position of the valves 12 and 13. When valve 12 is open and valve 13 is closed, the coldest temperature is achieved, whereas with valve 12 closed and valve 13 open the highest temperature can be reached. The degree of opening valve 12 is controlled as a function of the difference in temperature at each temperature measuring point, e.g. temperature measuring point 6, and the pre-set values of grape temperature.

The controller is set in such a manner that the feed of carbon dioxide is stopped as soon as pump 3 is stopped or the valves 21/22 are closed or the temperature measured at 8 or 9 is too low.

When the feed of carbon dioxide is started, advantageously, at first for approximately 5 seconds only valve 13 is open (gaseous feed) while valve 12 remains closed. This prevents liquid carbon dioxide being injected at high pressure via a nozzle 26 into the connection line 24 and/or 25. After expiry of the 5 seconds, valve 12 is slowly opened up to the degree of opening pre-set by the controller (PLC).

The cooling effect is monitored via temperature measurements at the temperature measuring points 6, 8 and 9. If the temperature measured there falls below 7°C, the PLC interrupts the feed of carbon dioxide. This reliably prevents freezing of the grapes or moisture freezing onto the connection lines.